



## NEVADA ENVIRONMENTAL COALITION

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# Critical Thinking Regarding Perchlorate Public Health Issues

## CRITICAL THINKING REGARDING PERCHLORATE PUBLIC HEALTH ISSUES

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### BACKGROUND:

The major source of drinking water for the Las Vegas Valley Water District is Lake Mead, which is part of the Colorado River System. Lake Mead supplies approximately 85% of the water served by the Las Vegas Valley Water District.

Ammonium perchlorate (rocket fuel oxidizer) has been found in the Las Vegas Wash that leads into Lake Mead with levels as high as 1,700 ppb. Lake Mead water and nearby wells are reported to have levels of zero to 47 ppb. Studies conducted between 1970 and 1974 confirmed that perchlorate was shallow ground water layers in the industrial area near Henderson. The Colorado River and Lake Mead serve as a drinking water source for somewhere between 11 and 32 million people in Nevada, Arizona, and Southern California.

According to the Environmental Protection Agency (EPA),<sup>1</sup> ammonium perchlorate is a man-made salt used as a component of solid rocket fuel. Perchlorate has been detected in various wells, in drinking water supplies, at various solid rocket fuel manufacturing and testing sites in California, Nevada and Utah. 110 public water supply wells throughout California have perchlorate in their water. The highest level reported in any California water supply well was 280 ppb with a few others at levels greater than 100 ppb. Wells testing positive for perchlorate by the American Water Works Service Company are located in CA, IN, IA, and PA.<sup>2</sup>

At Henderson, Nevada, two manufacturing facilities were found to have released perchlorate in groundwater. Kerr-McGee, in the Henderson BMI industrial complex, is an area draining into Lake Mead. The ground water in this area is contaminated to a reported high of 3,700,000 ppb at the Kerr-McGee site and 109,000 ppb at the former Pepcon site. Levels of 11-47 ppb have been found in the upper portion of the Las Vegas Wash and from 1,000-1,700 ppb in the lower portion of the wash<sup>3</sup>. Chromium and benzene were also used in the manufacturing process and have also contaminated ground water.

Perchlorate was also introduced deep into the ground-water basin by artificial recharge (AR) wells that pump treated Colorado River into the ground-water basin in order produce a mixture of ground water and treated Colorado River water. Perchlorate

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<sup>1</sup> Personal correspondence, Robert Perciasepe, Assistant Administrator, Environmental Protection Agency (EPA) to the author, September 30, 1997.

<sup>2</sup> *Perchlorate Contamination in the Environment*, discussion paper prepared for an Interagency Perchlorate Steering Committee stakeholders forum, Henderson, NV, May 19-21, 1998.

<sup>3</sup> SNWA Press Release, August 18, 1997.

levels at two artificial recharge wells were tested at 5.6 ppb and 13 ppb. A total of five wells have been used for artificial discharge<sup>4</sup>. Levels of 5 to 9 ppb of perchlorate have been detected in the Colorado River, the drinking supply for over 10 million people in California, Arizona and Nevada. The State of California and the Southern California Metropolitan Water District have traced the source as far upstream as the outlet of Lake Mead.

According to Southern Nevada Water Authority's data<sup>5</sup>, raw water perchlorate contamination ranged from non-detectable (ND)(10/20/97 & 11/21/97) to a high of 16 ppb on 12/30/97. Finished water contamination ranged from 4.1 ppb on 9/17/97 to a high of 14 ppb on 12/30/97. Curiously, on the dates when raw water was reporting ND, finished water was reporting 5 ppb.

The author conducted split-sample tests of finished drinking water delivered to his home at Summerlin, Nevada on 10/09/97. The samples were sent to two California laboratories certified by California to conduct testing for perchlorate. The results from one laboratory were 5.2 ppb and 7.3 ppb respectively at the kitchen sink faucet where the water has by-passed home conditioning. Samples taken from the home's reverse osmosis unit were ND. The results from the second laboratory were 5 ppb and 4 ppb respectively from unfiltered finished water, and ND from the reverse osmosis unit. Results of ND must be considered with caution. California only certifies laboratories to a low of 4 ppb. Levels of parts per trillion (ppt) are important in immunotoxicological research. Another sample of unfiltered pool water sent to one laboratory on 5/8/98, produced test results of 8 ppb and 5 ppb from shower head water after Culligan potassium and carbon filtration, and after chlorine filtration at the shower head.

The Las Vegas Valley Water District claims that, "The public water supply meets all the standards set forth by the Safe Drinking Act." There are no national primary drinking water regulations for perchlorate. Ammonium perchlorate is an unregulated contaminant pursuant to both federal and State of Nevada law. There are many other unregulated contaminants in our drinking water which are not routinely monitored and for which, no action levels exist.

Ammonium perchlorate at the levels currently contaminating the Las Vegas potable water supply, are not expected to cause any immediate, life threatening illness to adults. That does not mean that anyone in science or government knows what the longer term implications may be for this generation or succeeding generations. There is simply not enough information to pronounce water contaminated with ammonium perchlorate "safe." There are hundreds of trace metals, volatile organics, synthetic organics, disinfection by-products, radionuclides and bacteriologics in our drinking water. The scientific literature that is available involves mostly potassium perchlorate,

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<sup>4</sup> SNWA Press Release, *Perchlorate Results Received for So. Nevada's Raw, Treated & Ground Water*, August 11, 1997, pp. 1-2.

<sup>5</sup> Personal correspondence from Cynthia Williams, Administrative Secretary, Laboratory Division, SNWA to the author, April 29, 1998.

not ammonium perchlorate. The difference may or may not be important in immunotoxicological research.

California's Department of Health Services describes the health effects of perchlorate as, "The primary human health concern related to perchlorate is that it can interfere with the thyroid gland's ability to utilize iodine to produce thyroid hormones, which are required for normal body metabolism, as well as growth and development."<sup>6</sup> The 1997 ITER Peer Review Meeting Summary<sup>7</sup> expressed concern "that developmental toxicity (i.e. impaired neurological development) could be a critical effect of perchlorate that has not been adequately examined in studies to date." When prenatal and infant exposure was discussed, it was noted that hypothyroidism or iodine deficiency postnatally results in cretinism. A review of the research literature suggests homogenous hypertrophy and hyperplasia of follicular cells, decreased amount of colloid and increased vascularity in rats orally treated with 1% potassium perchlorate. After six months of treatment, true nodules appeared with complex morphology.<sup>8</sup> (i.e. homogenous, all of the same kind; hypertrophy, abnormal enlargement; hyperplasia, abnormal multiplication of cells; follicular, one of the small ovarian sacs.) Another study<sup>9</sup> suggested that perchlorate treated rats had increased levels of cholesterol, phospholipids and triglycerides in HDL, LDL and VLDL fractions. The risk factor increases in experimental animals, "indicating that the treatment of rats with perchlorate may develop the susceptibility of the animals to cardiac heart disease."

There is no credible scientific basis for any statement that any amount of ammonium perchlorate in potable water is safe. We all now know that perchlorate may damage the thyroid gland, cause fatal bone marrow defects, and may cause thyroid cancer. Assaults on the thyroid and bone marrow are particularly bad news for Nevada citizens as a result of decades of atomic bomb testing.

In support of our statement on safety, we submit Joan S. Dollarhide's October 23, 1995 cover letter and review (Review of Proposed RfD for Perchlorate) addressed to Mike Girrard, Chairman, Perchlorate Study Group. She noted that "there are many questions about the chronic effects of perchlorate left unanswered by the existing data."

Nevada is currently under fluoride industry pressure to add the contaminant fluoride a compound to the state's drinking water systems. California now has passed legislation that will result in the addition of fluoridate to that state's drinking water. Fluoride is known to be only slightly less toxic than arsenic. Now one knows what the synergistic

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<sup>6</sup> *Perchlorate in California Drinking Water*, California Department of Health Services, February 10, 1998, p. 1.

<sup>7</sup> *Notes from the March 1997 ITER Peer Review Meeting*, TERA NEWS, p. 16.

<sup>8</sup> *Induction of thyroid proliferative changes in rats treated with antithyroid compound*. *Anat Histol Embr* 20 (4): 289-298 (Dec 1991).

<sup>9</sup> *Lipoprotein profile during perchlorate toxicity*. *Indian J. Biochem Biophys* 26 (4): 273-274 (Aug 1989).

effects of combining these many toxins. There is no research planned regarding possible synergistic effects between fluoride and perchlorate, not to mention chlorine.

#### GOVERNMENT STANDARDS:

According to the EPA<sup>10</sup>, "[a]n RfD (reference dose) is an estimate of a daily exposure to the human population that is likely to be without appreciable risk of deleterious effects over a lifetime. The RfD is an estimate and may not be completely protective of every individual within a highly variable population, but neither are exposures above the RfD necessarily unsafe. Some individuals may have better adaptive or protective capacities than others and responses may vary with age and state-of-health; thus, individuals respond differently to toxicants exposure. An RfD value is derived from a No-Observable-Adverse-Effect Level (NOAEL) or Lowest-Observable-Adverse-Effect Level (LOAEL) approach by accepted, current risk assessment practice used by EPA."

In their letter September 20, 1997 letter, the EPA referenced a 1995 *Risk Assessment Issue Paper for : Derivation of Provisional Non-cancer and Cancer Toxicity Values for Potassium Perchlorate (CASRN 7778-74-7)* written by the National Center for Environmental Assessment of the Office of Research and Development, the EPA admits that most existing perchlorate "studies are of limited value in developing a chronic RfD." The 1995 review admits that with one exception, the studies (p. 1), "are limited by the fact that the doses tested were not at levels low enough to identify NOAELs and that no organs, tissues, or endpoints other than thyroid were examined." The one exception was criticized as not being "reported and/or translated well enough to be useful for risk assessment." The review noted that "[i]n addition, there are no reproductive or multigenerational studies." "In summary, the studies by Brabant and the cluster of studies showing fatal aplastic anemia clearly show that the duration of exposure affects response. (i.e. Aplastic anemia, "severe anemia due to destruction or depressed functioning of bone marrow".)

Thus the database for perchlorate is severely limited by the fact that there is no chronic study which is conducted at levels low enough to demonstrate a NOAEL and which examines the full range of potential toxicity's. p. 2, "... [N]o other studies, except Shigan (1963), even looked for effects other than thyroid. Given that several human studies show fatal bone marrow effects at the same dose levels at which thyroid effects are observed, it is possible that subtler bone marrow toxicity would be observed at even lower doses. Thus, without additional data, it is difficult to state with certainty that the critical effect has been identified." ... "In addition, the PSG report first defines the critical effect and then finds the studies that demonstrate the effect. This is not appropriate." (PSG, Perchlorate Study Group.)

The 1995 review went on to criticize the Perchlorate Study Group for recommending a 12 mg/kg/day dose from a particular study as "not an appropriate choice for several

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<sup>10</sup> Personal correspondence from Robert Perciasepe, Assistant Administrator, EPA, to the author, September 30, 1997.

reasons." One reason was that several studies noted effects at lower doses than the particular study chosen. Far worse, the 1995 review pointed out that the 12 mg/kg/day dose "is not appropriate because this dose is higher than doses which have resulted in human deaths from aplastic anemia resulting from perchlorate exposure." The 1995 review criticized a reference to "all known toxicity's of perchlorate to other target organs such as the ... hematopoietic (i.e., bone marrow) system are probably mediated by thyrotoxicity."... where no scientific evidence was presented to support the statement and none of the papers reviewed for this report address this issue. Further the author of the review "was not able to find evidence to support this statement after a limited search through the literature." The 1995 review cautioned, "Before we can disregard the effect of perchlorates on the bone marrow for risk assessment purposes, there needs to be much stronger evidence that the thyroid effects and bone marrow effects are directly linked."

#### CALIFORNIA GUIDELINES:

In establishing a conservative, allegedly safe level for consumption, California health officials set their temporary standard at 18 parts per billion. They arrived at that number by using a risk assessment process. The original calculation used the product of three uncertainty factors (1,000) or 10 for to adjust for using a study of short duration, 10 to provide protection for particularly sensitive individuals, and 10 to account for the deficiencies in the data available. In 1995 after "some discussion that a full 10 for data deficiencies may not be required," the 10 to account for the deficiencies in the data available was changed to a factor of 3.<sup>11</sup> The facts are that the 10 x 10 x 10 risk ranking computation that resulted in 4 ppb (1,000) is much more "conservative" than the 10 x 10 x3 computation (300) that resulted in the 18 ppb action level.

The 18 ppb temporary California perchlorate action level for drinking water comes from risk assessment computations that are essentially guesses that are influenced by political pressure and expediency. There is no science involved in the process. The admission that after "some discussion that a full 10 for data deficiencies may not be required" was a political process at work.

The author of this report once served on a state risk ranking project. He was successful in having the words "scientific" and "science" removed from the project report. The citizen review panel involved was shamed into admitting that risk ranking is heavily lobbied. Risk ranking is a political process where scientific discipline and training are not seriously considered. The results of risk ranking processes are an amazing pattern of action levels regularly established just above most of the problems.

The 1995 review described above was critical of the uncertainty factor change from 10 to 3. "The PSG report states that the only uncertainty factor needed is a factor of three to account for sensitive subpopulations." ... "This is not consistent with EPA's

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<sup>11</sup> *Perchlorate in California Drinking Water*, California Department of Health Services, February 10, 1998

approach. An uncertainty factor accounting for the extrapolation from less than lifetime studies would be required because all of the studies which identified NOAELs are acute or sub-chronic studies. An uncertainty factor for database deficiencies is required to account for data limitations including limited data on sub-chronic and chronic exposure to *low* doses of perchlorate, limited data on other organ systems, limited data on the effects on the hematopoietic system, and lack of reproductive and multigenerational data. A full uncertainty factor of 10 should be considered to protect sensitive sub-populations which would include groups not considered in the PSG report such as hypothyroid patients and individuals with low iodine diets or with genetically impaired iodine accumulation."

#### PUBLIC STATEMENTS THAT CANNOT BE SUPPORTED BY CURRENT LITERATURE:

The public is not well served when those with professional or scientific credentials make public statements that are misleading. One example involves statements concerning parts per billion in gallons of water. Such statements are pure disinformation if the toxicity of the chemical is not also considered and if toxicity and immunotoxicity information is not presented to the public at the same time.

From time to time, medical professionals have been invited to Nevada to address the ammonium perchlorate issue. Too often they have gone well beyond their experience, education and training in order to make statements that are not supported in the literature. Medical professionals have extrapolated from anecdotal medical literature, literature involving 155 lb. humans who have been clinically poisoned by physicians, to a population of millions who may have had long term exposure.

Current research assumes that actually drinking water contaminated with perchlorate is the primary risk. We do not know that. Showering in contaminated, vaporized water where perchlorate or any toxin is transmitted quickly and directly to the blood stream from the lungs is also a problem.

Many people have reverse osmosis units in their homes where the effects of drinking water contaminated by perchlorate are minimized. Public buildings including schools usually do not have access to reverse osmosis water. Polycarbonate water containers leach a chemical into water that mimics estrogen hormones. Other types of water treatment equipment, except for distillation methods, do not remove perchlorate.

Another issue is swimming in pools contaminated with perchlorate. Perchlorate is known to cause skin irritation, redness, rash, redness, itching and swelling.<sup>12</sup> Since the information has not been well publicized, skin disease caused by perchlorate is likely to be medically misdiagnosed in favor of explanations such as "hard water."

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<sup>12</sup> *Material Safety Data Sheet, Ammonium Perchlorate*, Hummel Croton Inc., N.J., CAS #: 7790-98-9, May 2, 1996.

## LONG TERM IMMUNOTOXICOLOGICAL EFFECTS:

The concern with toxic chemicals such as ammonium perchlorate is both their toxic effects, and their immunotoxic effects, or their effects on the immune and endocrine systems. We do know from anecdotal medical literature and from the available animal studies of similar toxins that there may be very subtle, profound, long term effects that could be serious.

## WHAT TO DO?

The choices we are left with are poor indeed. In the absence of technology proven to remove perchlorate from municipal water systems, the other choice is to remove the most heavily contaminated soil to safer storage sites. We must stop the water table contamination that is coming from the manufacturing sites. The alternative is reverse-osmosis treatment everywhere. By that we mean all public and private facilities. That prospect brings the scope of this public health crisis into focus.

## WE MUST LEARN FROM PAST MISTAKES:

Statements to the effect that the problem has existed for years, that Kerr-McGee has reported contamination problems to the state and county for ten years or more, and that our public health officials have done too little or nothing simply boggle the mind.

## SUMMARY:

1. No state or federal drinking water standards exist for the contaminant and toxic chemical, ammonium perchlorate. Water containing ammonium perchlorate is unlawfully contaminated with an unregulated toxin. By unlawful, we mean at a minimum, common tort law.
2. Nevada may not use California action levels without a lawful adoption process.
3. The California Department of Health Services (CDHS) paper Perchlorate in California Drinking Water fails to deal with perchlorate in either toxicological or immunotoxicological terms. The current California action level for perchlorate were not established pursuant to either discipline. Uncertainty factors (UFs) of 1,000 do not provide the degree of safety the number would appear to offer when one considers that immunotoxicological effects routinely appear for toxins at low number part per trillion (PPT) levels.
4. The decision process that resulted in a decision to massage the numbers again to come up with an 18 ppb action level as opposed to a 4 ppb action level was arbitrary and without a credible scientific rationale.

5. Government standards based on toxicological (i.e., the poisoning of an organism) considerations misrepresent health effect conclusions. It is the immune and endocrine systems we are concerned about. No one is claiming anyone is going to drop dead after drinking perchlorate at the levels being discussed.
6. The CDHS paper is based upon potassium perchlorate where the perchlorate found in Nevada is ammonium perchlorate.
7. Levels of perchlorate at PPB levels are, in immunotoxicological terms, not "very low levels." Immunotoxicological research is routinely at the part per trillion (ppt) level.
8. EPA "no observable adverse effects levels" are crude toxicology observations that do not consider immunotoxicological effects.
9. The concern about toxic chemicals in water is not necessarily that of drinking the water. The more important exposure may be from breathing perchlorate contaminated water in the shower. When perchlorate laden water vaporizes, perchlorate is likely to go immediately to enter the blood stream from the lungs. In that situation, the human body must deal with perchlorate in the blood stream immediately. Toxic chemicals are immune system stressors.
10. Risk assessments using a 157 lb. "standard" human do not provide a degree of safety for children and fetuses, or for those who are in poor health.
11. The EPA's acknowledgment of fatal bone marrow effects involving perchlorate doses in the 6 to 14 mg/kg/day and their acknowledgment that the finding is "particularly troubling" suggests considerably more caution is in order for dealing with perchlorate than the CDHS action levels would indicate.
12. There is no discussion of cumulative or synergistic effects with other toxic chemicals such as fluoride and chlorine in the CDHS paper or in any other paper.
13. There is no justification for anyone who either knew or should have known that water contaminated in a manufacturing process, injecting contaminated water into the lower Las Vegas ground-water basin.
14. Perchlorate should not be in drinking water at any level. Perchlorate must be removed from drinking water and wells containing the contaminant perchlorate must be closed.
15. Our federal, state and local governments are conducting an experiment on millions of humans without their informed consent.

**QUESTIONS:**

1. Does your agency have any scientific data other than data referenced herein that supports with credible science, a provisional RfD? If so, please provide the data. (Note: Where the word "scientific" is used herein, we include immunotoxicology in the definition of that word.)
2. Does your agency agree that the only ethical answer to the toxicity of perchlorate question is that there is not enough data to answer perchlorate toxicity questions with any answer other than, we don't know?
3. Are there any circumstances where your agency supports the delivery of ammonium perchlorate or rocket fuel oxidizer contaminated drinking water to consumers by regulation or inaction? If so, what are they?
4. Is your agency's water contaminant scientific research based upon the discipline of toxicology or immunotoxicology? Please explain your answer.
5. Does your agency agree that with regard to press releases and public statements, the words "trace," "tiny," "small," or "one part per billion is equal to one drop in a 55,000-gallon container," or similar words are scientifically misleading and are useful in bringing clarity to toxic chemical issues, particularly from the immunotoxicological point-of-view?
6. Does your agency agree that finding a provisional RfD for perchlorate was a scientific and ethical error?
7. Does your agency intend to stop using the California 18 ppb provisional RfD?
8. Are contaminants such as ammonium perchlorate lawful at any level in potable water pursuant to current EPA regulations or statutes? If so, please identify these statutes or regulations.
9. Is your agency aware of the study conducted in Nevada between 1970 and 1974 that found perchlorate in shallow ground water layers in the industrial area near Henderson, Nevada? If so, what did your agency do about that finding from that date to this date?
10. Does your agency agree that the current situation requires immediate and decisive cleanup action?

11. Does your agency agree that perchlorate plants must not be located anywhere they can theoretically contaminate a potable water supply?
12. Does your agency agree that there is a possibility that breathing water vapor in a shower containing perchlorate could be as dangerous or more dangerous than drinking the same water as a result of the more immediate access to the blood stream through the lungs?
13. Does your agency have any scientific or other information to indicate the type of municipal and home water cleansing units that may be effective against perchlorate?
14. Is your agency aware that the poor and many so-called middle-income families in Nevada probably do not have access to reverse osmosis water decontamination units? What does your agency recommend with regard to that fact that public buildings including schools and hospital, commercial businesses including restaurants, and government building do not have reverse osmosis units for their drinking water? Are those who drink from R/O units taking less risk than those who must drink from the facilities listed above?
15. There is evidence that perchlorate may have contaminated Las Vegas drinking water since WWII. Does your agency intend to investigate the failure of county and municipal officials and agencies to regularly test for perchlorate since the contamination information was either known to them, or should have been known to them?
16. What role has your agency had in detecting perchlorate in Las Vegas water since your agency's inception? Please provide us with copies of all NEPA data that supports your answer to that question.
17. What is your agency's position on one state using another state's provisional RfD in a situation such as the current perchlorate situation?
18. Will your agency become financially and legally involved in a Las Vegas clean-up of perchlorate?
19. What are the synergistic effects of perchlorate with other toxic chemicals known to be in the Colorado River and Lake Mead?
20. Tests are showing high levels of Radon in Las Vegas potable water. What is your agency's position on the issue of Radon in combination with perchlorate?
21. On what credible scientific basis have assurances been given to the parents of children and pregnant women regarding perchlorate?

22. What testing frequency does your agency consider adequate for perchlorate under the circumstances related herein?
23. What wells should be closed in the Las Vegas Valley as a result of perchlorate?
24. Does your agency, or does your agency know of any other agency that is in a position to brief the medical community in Las Vegas with regard to health issues in relation to perchlorate?
25. Does your agency have, or does your agency intend to set up, or request that another agency set up a registry to report those suspected to have health effects from perchlorate? If not, why not?
26. What is your agency's position on the issue of injecting perchlorate laden water into the Las Vegas ground-water basin?
27. What is your agency's ethical and moral responsibility to tell the public the truth about how much we do not know about perchlorate?
28. What is your agency's responsibility to stop this huge experiment on millions of humans without their informed consent?

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